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Notes on the Manner of Growth of the Cell Wall.

By Emily L. Gregory.

(Plate CIX).

The question of the manner of growth of the cell wall in the vegetable kingdom has not yet been satisfactorily answered. If we accept the theory of Nægeli in respect to the crystalline form of the micellæ composing it, and suppose the first or primary wall to be formed according to the laws governing the arrangement of such figures, when lying free in a fluid substance, the question then arises, how does this wall grow in surface and in thickness? Nægeli says in his work on the growth of the starch grain, that before this question can be answered many facts must be observed and registered.

The object of the present brief paper is to record one or two facts which appear to be connected with this question. It is not expedient therefore to give a resumé of the work already done and the facts discovered in this field since the suggestion of Nægeli. An article written by Krabbe in Pringsheim's Jahrbuch in 1887 contains an account of some very interesting observations and experiments, and in this paper the author claims to have proven one or two points in this connection which have hitherto lacked positive demonstration. Without taking space here to review this whole article, which is a long and valuable contribution to the literature on this subject, I may be pardoned for repeating some parts of it here.

In the study of stratification and striation in the walls of bast and thick-walled libriform cells, Krabbe claims that the observations preceding his own have been made on longitudinal sections, and therefore the results are not always reliable.

A stratified wall consists of several layers which appear to be quite distinct from each other when seen on the cross-section. These layers often appear striated, or as having stripings running more or less obliquely through them which on the cross-section show like narrow lines. Krabbe used cross-sections of different stems, *Linum, Urtica* and others, and by an ingenious method of focusing by which the lines, according to their relative position in the layer, were made to recede from or approach each other, claims to have proven that the process of intussusception could not have taken place in the growth in thickness of the entire wall. That is, he claims to have shown that the growth in thickness of each one of these lamellæ or layers was entirely separate from that of the others, and that no interchange of micellæ from one layer to another could have taken place.

The result of this study, ingenious as it was, led to no definite results as to the actual manner of increase of thickness in a wall already formed. Admitting that the two lamellæ are entirely independent of each other, each containing its own micellæ from the first, the question still remains, how did they reach their present thickness? He agrees with all the recent investigators on this subject, that in many cases a so-called new formation of wall occurs. To explain this we will suppose a cell with moderately thickened walls; this when about to add to its thickness throws out a new wall which eventually sets itself firmly on the old one so as to become part and parcel of it. This building a new wall by the protoplasm of an already enclosed cell is a process quite lately discovered and in German is known as "neubildung."

In another portion of his work he claims to have reached more satisfactory results; in fact to have actually proven that intussusception does take place in the increase of thickness in certain walls. In certain plants of the families Asclepiadaceæ and Apocynaceæ there occurs a process of widening or bulging out of the walls of the bast cells in a very singular fashion, and afterward a cellulose wall may be built across so as to form separate cells in the once single bast fiber. Now as to the growth of these widenings it is plain that the number of micellæ composing the growing cell wall must have increased considerably. The question how this increase is managed Krabbe answers by saying that it

can be in no other way than by intussusception. He gives elaborate arguments to prove that the turgor could not be sufficient to account for it on the principal of stretching, says that a pressure of from 3,750 to 5,000 atmospheres must be assumed in order to produce such a result, and that it is impossible to premise a pressure of more than 1,000 atmospheres in a cell. Other serious objections are given, and finally, because Strasburger denies that a cell can grow in surface by any other process than by stretching, he says, admitting it to have grown by stretching, we must then expect it to be proportionately thinner, but such is not the case. Measurements are given showing the wall to be of uniform thickness. Therefore it is proven that these local thickenings in the bast cells of these plants must be the result of the process of intussusception.

Then he gives his reasons for concluding that in most cases of thickened walls showing striation the process of new formation has taken place, a wall being built and then added to the previous one. He says, admitting this latter statement proven, "Still the real question is not touched, for who can say how this new wall increased in thickness in its process of growth, whether by apposition or intussusception." In the case of the growth of the widened places in the bast fibers, however, a definite point is gained; if the proofs are satisfactory then we may hold that the theory of growth in thickness by intussusception in some cases is established.

While the writer was studying the development of wings on the stems of the genus *Euonymus* one or two instances of peculiar growth were noticed. About eighteen different species or varieties of this genus were studied, but only one of them showed this peculiarity in wall formation. This was *Euonymus angustifolia*, var. *purpurea*; the specimens were obtained from the nursery of Thomas Meehan, near Philadelphia. This species has the usual four-angled stem with slight but perfectly developed wings along these angles. It will be necessary here to repeat a little from the work on cork wings referred to above: "A cross-section at the distance of ½ centimeter from the growing tip of stem shows the tissues of the rind in a formative stage. The outer wall of the epidermal cells is covered by a thin cuticle, the cells themselves

are large, nearly isodiametric, and with thin walls; below the epidermis are two layers of thin-walled cells without chlorophyll, then four or five layers of parenchymatic chlorophyll-holding cells, and then below these again several layers of colorless cells." At the corners of the stem the rows of chlorophyll-holding cells are broken by a cluster of collenchymatic colorless cells. In a later stage of development the central cells of this cluster form the string of bast fibers which are pushed out by the growing wing. It is with the growth and development of these bast fibers that a point of interest occurs. A section cut at the distance of ½ centimeter from the growing tip (Plate CIX. fig. 1.) shows this little central cluster of cells, with thick walls and small lumen; now a section at three centimeters from the tip shows that several important changes have occurred. The two cylinders of colorless cells now begin to take on a collenchymatic appearance, the walls having thickened considerably. The cells of the epidermis are in a state of rapid growth and division, new cells being added to the outer cylinder whose walls rapidly thicken, as may be seen by sections at the distance of five and seven centimeters from the tip. The cells in the center of the group in the corners are seen to have increased in diameter while at the same time their walls are much thinner.

Now if we follow this same set of cells, cutting at various distances below this, we find them with extremely thick walls, so that only a small point appears as the lumen. Their diameter is about the same as at the distance of three centimeters, but in whatever way the additional thickness has been acquired the original wall as seen at the latter distance is perfectly evident as a dark line marking the outline of each cell.

Here, if we accept Strasburger's theory, that growth in surface takes place by stretching, we have an apparently consistent explanation of the processes which have taken place. The thick walled cells in fig. 1 c., have changed to thin-walled wider lumened cells as seen in fig. 2, by using up the material already in their walls. By this process of stretching the diameter is increased until the proper size for the bast fibre is obtained. Then by a succeeding process this thin wall is added to until hardly a trace of cavity remains. If, on the other hand, as in the case of

the bast fibres described by Krabbe, it can be proven that the turgor cannot be raised sufficiently to produce this effect of stretching, the only other explanation possible is that the walls of the cells in question have undergone the following cycle of changes: Their thin walls produced by the original division of the cells composing them have been thickened so they have the appearance as shown in fig. 1; then the matter composing these walls has been partially absorbed till only the light wall remains as seen in figure 2; this must also have increased in surface to allow for the increased diameter as seen here. Then later on a new process of thickening has taken place, by which the wall is made much thicker then before. It must be noticed here that there is not the same difficulty in the way of the wall stretching out till the diameter required is reached as in the case described by Krabbe. Here the young walls are in their early stage of growth and there is every probability that a much smaller pressure would serve to extend them than in case of the bast fibers of an older tissue.

It is true that the simple fact that one explanation appears more plausible than another, is not at all of the nature of proof in scientific research. At the same time the rapid succession of changes noticed in the thickness of the walls of this tissue seems worthy of record as a fact bearing on this subject.

Another peculiarity still more striking than this occurs in the course of the rapid growth and division of the epidermal cells between the wings. As before stated, these originate from a phellogen layer extending not around the stem, but only for a short distance around and beyond the little cluster of bast cells, the wing shoving these out as it develops. In this variety the wing never acquires a very great depth, but is of width enough to materially aid in the enlargement of the circumference, while the spaces between are thus enabled to assimilate. It is only, therefore, on the spaces between these wings that the epidermal cells retain their character and divide, forming new ones. This process does not result in the formation of corky layers, composing the tissue known as periderm, but they form an additional support to the outer collenchymatic cylinder, which at first is only two layers in thickness. By means of these additional cells the

number is increased often to six or seven layers. In regard to these collenchymatic layers being necessary to support the stem, it may be mentioned in passing that this stem is one of the class having no bast fibers in its outer or rind portion.

The real periderm consists of the wings until the stem gets older—two or three years in some instances—when the assimilating surface is no longer needed, the bands of phellogen cells extend themselves until a circle is formed around the entire stem.

Now it is with the stem before the wings form and for some time after this, that we have to do. In order to allow the cells under the epidermis to fulfill their office of assimilating, the epidermal cells themselves must remain intact and perform their office as do the epidermal cells of the leaf. It is necessary, therefore, that they divide and increase rapidly in order to keep pace with the increasing growth in diameter. This in itself presents no difficulty as long as the cell contents are in working order and the cell wall is of pure cellulose, so that it can change in any way to enable it to increase in thickness or in surface; this process of growth and cell division is normal to the plant.

There is, however, one difficulty in this for the epidermal cells, which is not found usually elsewhere. This is the heavy upper or outside wall, the cellulose of which turns to suberin or cutin at a very early stage of the growth of the stem. One of the characteristics of suberin is that it is nearly impervious to air. It is also supposed to be much less liable to change of structure than cellulose. By this is meant that the micellæ composing it do not so readily change place, therefore change in form or structure is more difficult in case of suberized wall than that consisting of pure cellulose. In other words a cell with purely cellulose wall with living contents is always liable to changes by means of growth, while the wall turned to suberin or lignin is a sign of completed growth, fixedness of form.

Now in our *Euonymus* stem at a distance of one-half centimeter from the tip these epidermal cells are found partly suberized as to their upper wall, this wall is thicker than the other, but the shape of the cell is nearly cubical. At a distance of three centimeters from the tip and from this on till the stem has acquired some age, the outer walls of the epidermal cells are very

thick and strongly cuticularized. Instead of stretching across the cell at right angles with the radial walls, and parallel with the lower tangential walls, they are strongly inclined upward, many making a sharp angle. Here, where the wall is so plainly cuticularized, the process of division is rapidly going on; new walls are seen in both directions, tangential and radial. But, as before stated, the tangential divisions are limited for the most part to four or five layers of cells, forming the collenchymatic cylinder outside the palisade cells. The radial divisions, of course, keep pace with the increasing circumference, and the outer tangential wall must increase at a rapid rate; it must increase not only in surface, but it does keep pace in thickness, for no section can be made which does not show all the cells of the epidermis fitted with outer walls of uniform thickness.

Now if we turn to the sections studied, we shall see a peculiar development which must in some way serve to aid in this series of rapid changes. We have before mentioned a curvature in the wall in nearly all cells in the process of division (which process is detected by the thinness of the new wall). Besides the thin new wall just forming, there is another element which, so far as I know, is peculiar to this variety. This is a sphere or spherical body consisting of partly cuticularized cellulose, extending from the outer wall down into the cell, to which in all cases is attached the new wall. That is to say, this spherical body projecting down into the cell was never found unless below it was the new radial wall which was just forming to increase the number of cells in the circumference. New cells were sometimes seen without the sphere, but the sphere is never found without the wall. Now by a study of the surface of these cells the following facts are recognized:

These spheres are found principally or more frequently on the tangential walls of the grown epidermal cells. At the stage where they are most numerous, these cells have a long diameter parallel with the axis of the stem. The tangential diameter is the one which must enlarge so rapidly to keep pace with the increase in circumference, and these bodies occupy such a position as to be readily made use of in the new outer wall.

If we suppose this to be the function of these bodies, the

question at once arises. By what process is their substance taken up into the wall? There is little probability that the latter stretches out so as to use up this material, as in the case of the cellulose ring in the *Œdogonium* cell. The shape is not adapted to this purpose, therefore a process similar to that of intussusception must take place. The assumption that this is the function of these globular bodies, and that they are merely reserve stores enabling the outer wall of the epidermis to preserve its uniform thickness, we admit, rests on very slight proofs. There are, however, several indications which point in this direction.

Chemically, they agree perfectly with the outer wall from which they extend. The greater portion of this wall consists of cutin in its early stages, a layer of pure cellulose is found to extend along the inner surface connecting with the side walls, and this cellulose extends entirely around the sphere. In fact, it is as though a little bag of cellulose membrane were sunken in here and filled with cuticularized substance. There is no question as to its chemical nature, as it was repeatedly and thoroughly tested. Again its connection with the new young wall is suggestive of this function. Except for this, its appearance is quite similar to the incrustations of calcium carbonate sometimes found in the epidermal cells of *Ficus.** However, cystoliths do not occupy such a position in reference to new walls, neither do they consist of cuticularized cellulose. Another reason for the assumption is the lack of these bodies in the epidermis of the grown stem, or that portion where the new periderm is about to form and the epidermis is to be thrown off.

EXPLANATION OF PLATE CIX.

Figures 1, 2 and 3 represent cross-sections of stem of *Euonymus angustifolia*, var. *purpurea*. They include only a corner in each instance, containing a bundle of bast cells, which appears in fig. 3 in a mature or finished condition.

Fig. 1 shows a section cut one-half centimeter below the tip of the stem, fig. 2 three centimeters, and fig. 3 twenty-five centimeters from this tip. In each of these figures *a* marks epidermal tissue, *b* the subepidermal or supporting-cells, and *d* those holding chlorophyll.

In fig. 1, *c* marks the collenchymatic cells of the corner, which later on develop into bast fibers. In fig. 2, these cells *c* are thin-walled, and have a larger lumen. In fig. 3 the same letter marks the cluster now completed.

Fig. 4 represents the epidermal layer as seen from above—distance from tip of

*See Haberlandt Physiologische Pflanzen Anatomie, page 340.

stem about twenty-five centimeters: *a* marks the spherical projection into the cells.

Fig. 5 shows cross-section through epidermal and subepidermal layers at the same distance from tip as in fig. 4; *a* shows here the spherical projection.

Fig. 6.—Same as fig. 5, only a longitudinal section.

Fig. 7.—Cross-section showing epidermal cells, cut one-half centimeter from tip; *a* here shows beginning of a stoma.

A Further Enumeration of some Lichens of the United States.

By Dr. John W. Eckfeldt.

The following account includes a few lichens heretofore but little known as occurring within the limits of the United States, and as two of these species have been described elsewhere, and as they are comparatively new or uncommon to the region specified, I deem it wise to call further attention to them. It will be further noticed that I have included three new species; these were collected during the winter of 1887, and were kindly identified by Dr. W. Nylander, whose descriptions I here include. Formerly the other plants were recorded as occurring only in the island of Cuba.

Lecidea (Biatora) mesophœa, Nyl. spec. nova. Thallus cinerascens vel cinereo-virescens, subleprosus, tenuis, indeterminatus; apothecia livido-nigricantia (latit circiter 0.5 millim.), lecanoroidea obmarginem conceptacularem albicantem (vix prominulum), intus strato media obscurato; sporæ 8-næ, fusiformes, 3-septatæ, longit 0.011-15, crassit 0.004 millim., epithecium incolor, paraphyses non discretæ, hypothecium supra fuscum infraque incolor. Iodo gelatina hymenialis cœruliscent, dein fulvo rubescens.

Species videtur e stirpe *Lecidia* (*Biat. violaceæ* ab. omnibus distincta apotheciis intus albis striato hypotheciali superiori infuscato. Tuckerman in hb. eam dexit *Platygraphan* et adert quædam facies *Platygraphæ prominulæ*, Nyl. Enumer. p. 131 Guyanensis quae vero distat hypothecio fusco et alus notis varus.

A rather rare and well marked species found throughout Florida, but recently collected at Jacksonville on barks at the base of various trees, by Mr. Calkins. This plant evidently belongs to the more tropical regions of America, and may be found by careful search in the island of Cuba.

Lecidea (Biatora) orphnœa, Tuck. Proceed. 1864 p. 274. Tuck. synop. pars. 2, p. 157. Thallus obscure rufescens, mi-

nute granulosus, sub. furfuraceus; apothecia fusca planiuscula marginata aut demum convexiuscula immarginata (latet fere 0.25 millim.), intus obscura; sporæ 8-16-næ. incolores oblongæ simplices, long 0.005-9 crass. 0.002 millim.; epithecium incolor, hypothecium fuscum. Iodo gelatina hymenialis fulvo-rubescens (præcedente cœrulescentia). Species satis distincta in stirpe *L.* (*Biatora*) *furfuraceæ*, Pers.

Tuckerman refers to this plant as occurring on trees in Cuba, and collected there by Mr. C. Wright. We have been able to place this rare plant among the flora of North America. It was found during the winter of 1887 on the bark of *Ilex Cassine* by Mr. Calkins, and from the material submitted to me, I was led to suppose that it was heretofore unobserved.

LECIDIA (BIATORA) MILLEGRANA, (Tayl.) sub. LECANORA, Nyl. N. Gran. p. 64; LECANORA PYRRHITIS, Tuck.

Another species peculiar to Cuba as referred to by Tuckerman, and found at Jacksonville on the bark of various trees. A well-marked and exceedingly interesting species also of subtropical distribution.

ARTHONIA CINEREOPRUINOSA, Schær. Sporæ 3-4-septatæ, long. 0.011-15, crass, 0.0035-45 millim, spermatia recta, long. 0.004-5, crassit 0.0006 millim. Iodo gelatina hymenialis dilute coerulescens, dein fulvo-rubescens.

This lichen was found in small quantities, but in sufficient amount to clearly and accurately determine the species. It occurred at Jacksonville and Palatka on smooth bark of *Ilex Cassine*.

ARTHONIA PALMICOLA, Ach. Syn. p. 5. Est quasi *A. epipastoides*, Nyl. sporis minoribus, 1 long., 0.011-14, crass. 0.004-5 millim.

Under the latter name Mr. Willey says the plant occurs in the Atlantic States. I have received it from Jacksonville, where it appears to be quite a common species.

GRAPHIS VIRGINALIS, Tuck. Similis *Ferrurinæ sub-nitidæ*, Nyl. Fueg. Patag. p. 34, sed sporis intus minus loculosis; long. 0.025-34 crass. 0.012-17 millim., et iodo coerulescenti obscuratæ.

Found on smooth barks in the low country of Florida, and heretofore not in any recent list of lichens from that section of North America. This plant belongs more properly to the tropical Graphids.

GRAPHIS VIRGINEA, Esch. Sporæ long. 0,050-75, crass. 0.016-18 millim. Iodo coerulescentes et simul thalamium coerulescens.

GRAPHIS VIRGINEA, Esch. var. FULVESCENS, Tuck. (*G. scalpturata*, var. *fulvescens*, Tuck, hb.) Apotheciis hiascentibus, demum planis, testaceo-pallescentibus.

OBS. *Graphis subvirginea*, Nyl., est *Gr. virginiæ*, Mont., quœ non est *Gr. virginea*, Eschw.

This lichen occurs throughout the northern portion of the United States, and has been distributed under the name of *G. scalpturata*. It occurs in Florida about Jacksonville on *Ilex Cassine*.

GRAPHIS SUBFULGURATA, Nyl., spec. nova. Thallus macula pallida indicatus; apothecia obducta vel subobducta, gracilia, flexuosa et ramosa, epithecio angusto; sporæ 8-næ, fuscæ, oblongæ, quadri loculares aut triseptatæ, long. 0.018-21, crass. 0.006-8 millim. (Iodo non tinctæ); hypothecium incolor.

Forsan et *Ferrurina* consideranda; accedere tamen videtur versus *Gr. fulguratam* Fee, cui sporæ minores 1 long, 0.011-15 crassit. fere 0.007 millim. A lichen having given much doubt as to its identity may now be placed here as a well authenticated species.

This lichen, not observed by all collectors, however, abounds throughout Florida, and has been more frequently observed in the neighborhood of Jacksonville. The specimens that I had were collected by Mr. Calkins.

PYRENULA SUBPUNCTIFORMIS, Nyl., nova spec. Sat similis *P. punctiformis*, Ach., at sporis triseptatis et nonnihil majoribus, long. 0.018-22 crass. 0.006 millim.

A not uncommon species, frequently found associated on the same bark with *P. punctiformis* and other *Pyrenulæ* and probably mistaken for *P. fallaciosa*, Stitz.

Notes on Asplenium pinnatifidum, Nutt.

So remarkable have been the discoveries of *Asplenium pinnatifidum*, Nutt., in Lancaster Co., Pa., during the present season, that a few notes concerning it seem to be worth recording. *A. pinnatifidum*, Nutt., was first discovered in this county by Prof. T. C. Porter, June 14th, 1864, near Georgetown, and afterwards

on the Tucquan Creek several miles from its mouth. In 1868 at a point on the Octoraro Creek, near Nine Points, it was collected by Dr. A. P. Garber. On the 1st of April last, while botanizing along the Pequea Creek with my friend, Mr. A. A. Heller, I collected this rare and beautiful fern for the first time. Since then I have collected it at four new stations, at two of which it is quite rare, while at the other two stations it is remarkably plentiful.

On May 21st, in a deep and wild ravine near Smithville, which was never explored, I found great quantities of *A. pinnatifidum*, Nutt. growing in the crevices of the high cliffs. Then on June 26th, while collecting along the Susquehanna several miles above Safe Harbor, in a very rocky ravine, I unexpectedly came upon it. Both here and at Smithville there is one spot where a peculiar form grows. The frond is two to three times broader in proportion to the length than in the common form, and regularly divided to the rachis almost to the apex, the pinnæ being ovate in outline. I started out on July 21st to collect specimens at the stations given by Prof. Porter and Dr. Garber. Somehow I failed to find either, but discovered a new station on the cliffs of the Octoraro about three miles east of Prof. Porter's locality and several miles west of that of Dr. Garber. The last station at which I have collected it is on the rocks at the mouth of the Tucquan Creek. At the localities where it grows so plentifully it varies much both in size and form. The fronds vary in length from two to twelve inches, and in width from one-half to two inches. Many of my specimens have long, sharp lobes at the base of the frond, and in some they run all the way up to the apex, instead of the usual rounded lobes. One very fine specimen, three of whose fronds are almost one foot long, has one frond taking root at the apex, which gives rise to four small fronds.

JOHN K. SMALL.

Lancaster, Pa.

A new North American Lejeunea.

BY LUCIEN M. UNDERWOOD.

Among the extensive hepatic collections made by Professor John Macoun in British Columbia during 1889-'90, a single *Lejeunea* occurred, which was referred to Dr. Spruce, who has

sent the following description and notes. It is especially interesting as the first occurrence of the genus in Northwest America.

LEJEUNEA (COLOLEJEUNEA) MACOUNII, Spruce, n. sp.—Dioica (?), pusilla, albido-viridis, in plagas circumscriptas diffusa; caules 4-5 millimetra longi, filiformes, pellucidi, vage vel inæqualiter-pinnatim ramosi, intricati, parce radicellosi. Folia imbricata, patentia, subplana vel apice decurvula, basi brevi subtransversa inserta, oblique obovata, rotundata, medio margine postico late (non autem profunde) sinuato-complicata, papillulis scabra margineque subcrenulata; lobulus duplo brevior ovato-quadratus, ad sinum truncatus et bidentatus, lævis, ad plicam inflatus, deinde appresso-planus; cellulæ minutulæ, subincrassatæ, ovali-4-6-angulares, omnes fere medio papillulam globosam ferentes, præterquam paucæ subbasales (ceteris longiores) necnon lobuli cellulæ epapillosæ. Foliola nulla. Flores in caule ramisque terminales, innovati. Bracteæ erectæ, foliis breviores, laxe complicatæ, lobo anguste oblique obovato, lobulo duplo breviore lineari sub-acuminato; bracteola nulla. Perianthia emersa, dimidio infero obconica, supero rectangulari-oblonga, paulo compressa, alte 5-carinata, subtruncata, ubique præter basin versus papilluloso-scabra. Cetera haud visa. Folia .8×.5, lobulus .4×.25, cellulæ 1-60; bractæ lobus .65×.3; perianthium, .75×.3mm.

Hab. British Columbia, on maple bark, (Prof. Macoun), April 8th, 1889.

This elegant species is very distinct from all *Cololejeuneæ* hitherto described. Scabrous leaves are not infrequent in the group, but in *L. Macounii* the roughness arises from the presence of a globose papilla on each cell of the leaf proper, or greater lobe, such as exists in no other species known to me. The lobule, or lesser lobe, however, is smooth as it is also in *L. calcarea*, Lib., whose acuminate and muricate leaves amply distinguish it. *L. Macounii*, by its habit and by the form of its leaf and lobule, recalls a common tropical foliicolous species, *L. pellucida*, which belongs to a distinct group (*Diplasiolejeunea*) possessing large two-ranked underleaves. RICHARD SPRUCE.

February 3, 1890.

Botanical Notes.

Polygonatum biflorum, Ell., grows with us and is very common. *Polygonatum giganteum*, Dietr. in its wiid form is very local, thus far being known only in the extreme northwest of the

State, although it is not uncommon in Windham Co., Conn. It is cultivated in many of our gardens and from the peculiar development in its degradation, I am very well satisfied that the one is a form of the other, for plants which were last year agreeable to the description, "glabrous throughout," "leaves partly clasping," "filaments smooth," "filaments inserted upon the middle of the tube," and therefore *P. giganteum*, this year from the same roots produce only such plants as have "sessile leaves," not "clasping," which are "pubescent and glaucous" beneath—with "roughened filaments" upon the "uppermost portion" of the perianth.

This is not the first time the impression has come to me concerning this plant, that two forms of one species were counted as two species, but I have had this season a better opportunity for observation of the matter. JAMES L. BENNETT.

Brown University.

A Handbook of the Mosses of Northeastern America.—Having learned that the edition of Lesquereux and James' "Manual of the Mosses of North America" is almost exhausted, and being assured that there is, in the East, a demand for a smaller and cheaper guide to the study of this group of plants, I have commenced the preparation of a work to bear the above title. The book will be illustrated, and the geographical area will include the northeastern and central States and eastern British America. It is hoped that the manuscript and drawings may be completed by the end of next year. ELIZABETH G. BRITTON.

Note on the Eastward Extension of Pentstemon albidus, Nutt.—In April, 1890, undoubted specimens of *P. albidus*, Nutt. were sent to the University of Minnesota, by Mr. L. M. Moyer, from Montevideo in the upper Minnesota Valley. It appears to be fairly abundant along the southern bluffs of the Minnesota River, in Big Stone, Chippewa and Renville Counties, and is apparently extending eastward along the valley. In this region *P. grandiflorus*, Nutt. is remarkably prevalent on high ridges and the two species occur together in the vicinity of Appleton. The range of *P. albidus* as given in the 6th edition of Gray's Manual is "Plains, Neb. to Dak. and Tex.," in Coulter's Manual of Rocky Mountain Botany, the range is, "Plains from Dak. to Col. and Tex." In

Minnesota it is restricted to the southwestern portion of the State and is not found on upland or rolling prairie, so far as yet determined. This plant has never before been reported east of the Missouri River. CONWAY MCMILLAN.

Note on Asplenium pinnatifidum. Considering the few recorded localities for *Asplenium pinnatifidum*, I think the following notes may prove of interest:

In June, 1886, Messrs. A. P. Brown, Stewardson Brown, and myself found this species growing sparingly on rocks in a deep glen on the west side of the Susquehanna River at York Furnace, York Co., Penn. We found it in the same locality in 1889 and again in June of the present year. On the last occasion, being convinced that the fern ought to be found in other similar localities along the river, we made a careful search for it and were rewarded by finding it in several other places in the woods bordering the river below York Furnace. In all cases it was growing on perpendicular rocks of an eastern exposure. No doubt further search will discover it at various other points along the river.

Another locality from which I have seen specimens of *pinnatifidum* is on a tributary of the Brandywine Creek near Mortonville, Chester Co., Penn. These specimens were collected by Miss Mary Steele a number of years ago, and I doubt if the plant is still to be found in this locality, as I have visited the place a number of times and have never been able to find it.

WITMER STONE.

Germantown, Pa.

Notes on two Carices.—Carex deflexa, Hornem., var. *Deanei*, Bailey. While collecting on the embankment of the old "Veazie Railroad" at Old Town, on May 24th, I found a small clump of this species—the only one I found that day. A few days later I found it growing in dry open woods at Orono, and have since found it quite abundant in a number of similar localities. The only station in Maine, recorded in the Manual, is Mt. Desert, 45 miles to the south.

Carex chordorhiza, Ehrh., is quite abundant in the "Bangor Bog," in Orono. Professor Bailey writes that he never heard of it before in Maine. MERRITT L. FERNALD,

Orono, Me.

Aconitum Fischeri. J. D. Hooker. (Bot. Mag. t. 7130).

Sir Joseph Hooker adopts this name for the Aconite of northeastern Asia and refers to it the *A. Columbianum*, Nutt. of the Rocky Mountains and Pacific coast, and the recently published *A. Noveboracense*, Gray, (BULLETIN, 1886, p. 190) of central New York; he even suggests that they all may have to go into the eastern North American *A. uncinatum*, L. Whatever may be the merits of *A. Columbianum*, which has already been regarded by American botanists at one time or another as identical with the Asiatic plant, we feel confident that *A. Noveboracense* represents a distinct species, and that *A. uncinatum* is equally valid. *A. Noveboracense* appears to us nearer related to *A. paniculatum*, Lam., of central Europe than to *A. Fischeri*.

N. L. B.

Alleghanies of Virginia in June—The. Anna M. Vail. (Garden & Forest, iii. 367, 368; 391–392).

Bur Oak—A Fine. (Garden & Forest, iii. 402, illustrated).

Accompanying a general description of *Quercus macrocarpa* is an account and representation of an individual specimen known as the "Cravath Tree," growing upon the farm of Mr. Miles G. Cravath, Whitewater, Wis.

Catalogue of the Uncultivated Flowering Plants Growing in the Ohio State University Grounds. Moses Craig. (Bull. Ohio Agric. Exp. Sta., i. 49–110, with map of grounds).

This list is concerned with the phanerogams only and contains 468 species and varieties. Common names are given in every instance where a common name is known. Tables of comparison are included, showing the number of genera and species in each order as found in the University grounds and as reported for the entire State. Also a table of comparison, showing the number of species in ten of the principal orders in the University grounds, Franklin County, and State. In like manner the number of species in the genera *Carex* and *Aster* are compared. The catalogue is manifestly a carefully prepared one and is unusually precise and full in regard to dates and locations. The nomenclature is somewhat antiquated, but as the author says he has been "striv-

ing always to employ the names sanctioned by the late Dr. Gray" the synonomy may be readily hunted up, especially as in numerous instances the author has caused synonyms to be printed in brackets. The work will certainly render the future study of botany at the State University a much easier task than when the author first undertook it.

Color Notes on California Wild Flowers. C. R. Orcutt. (Garden & Forest, iii. 438, 439; 450–451).

The author seems to think that color characteristics are apt to be "frequently ignored by botanists" and hence takes pains to say that he has compared his descriptions with the colored plates given in Ridgeway's "Nomenclature of Colors for Naturalists" and we are treated to such tints as "deep claret-brown" for *Fritillaria biflora*, "bright magenta" for *Lathyrus venustus*, "Heliotrope purple" for the spots in the corolla of *Frasera Parryi*, "Chinese orange" and "orange-vermilion" for *Calochortus Kennedyi*, "Pomegranate purple" for *Opuntia prolifera*. We are told that the corolla of *Erythræa venusta* is "of a shade belonging somewhere between solferino and magenta, too dark for rose purple!" *Læselia tenuifolia* has flowers "something between a poppy-red and carmine." *Sphæralcea Emoryi* has "flame-scarlet" flowers. *Monardella lanceolata* is described as having "Phlox-purple" flowers, while the flowers of *Thamnosma montanum* are "prune-purple." It certainly would require a highly colored imagination to picture the appearance of the descriptions in Gray's Manual, for instance, if such a code of color nomenclature should be adopted.

Caraguata angustifolia. J. G. Baker. (Bot. Mag. t. 7137).

Contributions to Texan Botany. N. L. Britton. Trans. N. Y. Acad. Sci. ix. 181-185).

This includes (1) Additions to the List of Plants collected by Miss Mary B. Croft at San Diego, sixty-seven species being enumerated *Lippia ligustrina* (Lag.) Britt. is the older specific name taken up for *L. lycioides*, Steud. Several corrections are made in former determinations. (2) Note on some plants collected by Mr. Frank Tweedy in Tom Greene County in 1879, an enumeration of ninety-nine species, *Desmodium Tweedyi* being described as new.

Cratægus coccinea, L. var. macrantha, Dudley. L. H. Bailey. (American Garden, xi. 513, 514, fig. 1).

Dangerous Fungi. H. W. Harkness. (Zoe, i. 151-152).

Diatoms—Movements of. C. Onderdonk. (Microscope, x. 225-229.

Dogwood—The Flowering. (Garden & Forest, iii. 425, 426, fig. 54).

Includes a picture of a fine tree of *Cornus florida*, growing on the estate of A. L. Barber, Grimes' Hill, Staten Island, N. Y.

Elm—The Clark. (Garden & Forest, iii. 438, illustrated).

An account and figure of a celebrated tree of *Ulmus Americana*, growing upon the Clark-Hancock place at Lexington, Mass. and known to be about 125 years old.

Episcia maculata. (Bot. Mag. t. 7131).

Native of British Guiana.

Fermentation of Bread. Katharine E. Golden. (Bot. Gaz. xv. 204-209).

In this article the author describes the experiments made to determine the main factor in the raising of bread—whether due to *Saccharomyces cerevisiæ* or *Bacillus subtilis*. In conclusion she says: "It was demonstrated by the experiments that both yeast and bacteria can separately raise bread, and, under the conditions of the experiments, the yeast somewhat better than the bacteria. Now, whether or not they act together in raising bread ordinarily was not demonstrated, but from the fact that both organisms were found in large quantities in dough that had been raised by Fleischmann's yeast, and that bacteria are always in the air and in large quantities on the surface of the grain from which flour is made, and also that they occur in all preparations of yeast ferment, it seems to be the only satisfactory conclusion that both the bacteria and the yeast act together in raising most if not all kinds of bread."

Flora of the Californian Islands. T. S. Brandegee. (Zoe, i. 129-148).

This is essentially a list of the flora of these islands as recognized by the writer: 512 species are enumerated. The object of the paper is evidently to make an opportunity to throw doubt on the validity of the numerous species described from the territory

by Professor Greene, a large number of which are here referred to mainland plants, the whole subject of the enumeration of the flora having just been exhaustively treated by Dr. Yates. Some of these reductions are probably desirable, as Professor Greene has proposed them, but a considerable number at least are very wide of the mark. The reference, for example, of five *Eschscholtzias* back to *E. Californica* indicates either that Mr. Brandegee's botanical instinct is not very highly developed, or else that personal dislike of Mr. Greene is warping his judgment. The nomenclature of the list is, to say the least peculiar, Linnæus being in several cases credited with binomials which he never wrote. N. L. B.

Flowers and Insects—V. Chas. Robertson. (Bot. Gaz., xv 199-204).

Insect visitors to the following plants are noted; *Astragalus. Mexicanus, Strophostyles angulosa, Amphicarpæa Pitcheri, Cercis Canadensis, Cassia Chamæcrista* and *Cassia Marilandica.*

Fungi of Western New York. Charles E. Fairman. (Proc. Rochester Acad Sci. 43-53; two plates. Also reprinted).

A general account of the mycologic flora of the region, followed by descriptions of new species in the following genera: *Didymosphæria, Anthostomella, Pseudovalsa, Vermicularia, Phoma, Diplodia, Sphæropsis, Sporidesmium, Mucor* and *Camarosporium.*

Fungous Diseases of the Spinach—Some. Byron D. Halsted. (Bull. No. 70, N. J. Agric. Exp. Sta.)

Peronospora effusa, Colletotrichum Spinaceæ, Phyllosticta Chenopodi, Entyloma Ellisii and *Cladosporium macrocarpum,* are figured and described.

Germination of Milkweed Pollen—Artificial. Byron D. Halsted. (Microscope, x. 229, 230, illustrated).

Observations upon the pollen of *Acerates viridiflora.*

Hansteinia et Stenostephanus—Sur les Caracteres des. H. Baillon. (Bull. Mens. Soc. Linn. Paris, i. 855).

A discussion of the relations of these Mexican genera.

Helianthemum—A New. W. H. Evans. (Bot. Gaz. xv, 211).

H. Canadense var. *Walkeri* is described from specimens collected at Castle Rock, Colo., by Mrs. S. B. Walker.

Hepatiques Nouvelles des Colonies Francaises. E. Bescherelle et Richard Spence. (Bull. Soc. Bot. France, xxxvi. 177–189, t. XIII–XV).

In the prefatory note M. Bescherelle explains that his only collabration consisted in sending the material and notes to Dr. Spruce. The species are arranged geographically, thirteen from Guadaloupe, in the genera *Mylia, Lejeunea, Blepharostoma, Cephalozia, Kantia, Leioscyphus* and *Jungermannia;* one *Lejeunea* from French Guiana and the remaining six species not American.

Hepaticæ Novæ Americanæ Tropicæ et Aliæ. Richard Spruce. (Bull. Soc. Bot. France, xxxvi. 189–207, t. XVI–XVII.

These also were sent to the author by M. Bescherelle, three from Mexico, fourteen from Paraguay, two from the Argentine Republic and fourteen from Brazil collected by Balansa, Hieronymus and Glaziou. The following genera are represented: *Frullania, Lejeunea, Radula, Lophocolea, Aneura, Riccia, Anthoceros, Lepidozia, Chiloscyphus, Plagiochila* and *Metzgeria.* Under *Lepidozia plumæformis*, n. sp., is cited one of Dr. Rusby's collection from Bolivia. The plates in both these papers are lithographed from drawings by W. H. Pearson.

E. G. B.

History of Garden Vegetables—The. E. L. Sturtevant. (Am. Nat. xxiv. 719–744).

Notes are given upon the following plants: "Skirret," (*Sium sisarum*); "Snails," (*Medicago scutellata*); "Soja" Bean, (*Soja hispida*); "Sorrel," (*Rumex sp.*); "Southernwood," (*Artemisia Abrotanum*); Spinach, (*Spinacea, sp.*), and Squash, Pumpkin and Gourd, (*Cucurbita, Pepo, Melopepo*, etc). The latter vegetables are described at some length, and the memoranda in regard to the importance of squashes and pumpkins as a food product in early colonial times are of considerable interest. Whether or not they all originated in this country seems still to be in doubt, but the author concludes that * * "as the present types have all been recorded in the Old World since the fifteenth century, and were not recorded before the fourteenth and succeeding centuries, there must be a connection between the fact of the discovery of America and the fact of the appearance of pumpkins and squashes in Europe." In regard to the gourd the author thinks there is

still room for investigation in regard to its status as a native or introduced plant in this country, but apparently inclines to the belief that it has been introduced.

Hypoxylon Broomeanum, Berk. and Curt.

It is remarked in "Grevillea," xix. 21, that specimens named *H. amorphum*, Ell. and Ever. are clearly the above species.

Kalmia—A Curious Form of. C. S. Sargent. (Garden & Forest, iii. 452, fig. 56).

Description and figure of a monstrous form of *Kalmia latifolia* found at Deerfield, Mass. The corolla lobes are divided into five linear petals, alternate with the calyx lobes, and some of them producing abortive anthers. The variety seems to be constant, can be propagated by grafting, and is freely fertile in cultivation.

Locust Trees—The American. (Gard. Chron. viii. 181, 182).

An interesting account of *Robinia pseudacacia* in Europe, especially of the individual, yet living in the garden of the Museum in Paris, which was known to have been raised from seed in 1635, and is believed to be the first of its species that was made to grow in the Old World.

Neolindenia, Sur le. H. Baillon. (Bull. Mens. Soc. Linn. Paris, i. 851, 867-868).

Notes on a new genus, doubtfully referred to the Acanthaceæ, from Chiapas, Mexico.

Notes on the Canyon Flora of Northwest Nebraska. T. A. Williams. (Am. Nat. xxiv. 779, 780).

Notes on the Flora of the Lake Superior Region. E. J. Hill. (Bot. Gaz. xv. 140–149; 159–166).

Notes on the Ligneous Vegetation of the Sierra Madre of Nuevo Leon. C. G. Pringle. (Gard. & For. iii. 337, 338, 362–363).

Outlines of Wood's "How to Study Plants." (Pamph. pp. 28. Indiana Teachers' Reading Circle, 1890-'91).

Passiflora vitifolia. (Gard. Chron. viii. 212, fig. 32).

Pleurothallis platyrachis. (Bot. Mag. t. 7129).

Native of Costa Rica.

Prunus Allegheniensis. T. C. Porter. (Garden & Forest, iii. 428, fig 53).

A capital figure of this interesting species.

Pyrus arbutifolia. C. S. Sargent. (Garden & Forest, iii. 416, fig. 52).

In this contribution the author contends for specific rank for the two plants generally regarded as var. *melanocarpa* and var. *erythrocarpa.* Marked differences in time of flowering, size and color of fruit and time of its ripening and falling, in addition to leaf characteristics, are given. Under this arrangement we should have *Pyrus arbutifolia,* (L.) L.f. for the red-fruited species and *P. nigra* (Willd.) Sargent, for the black-fruited one. The point seems to us to be well taken.

Ruelliées exceptionnelles—Sur Plusieurs. (H. Baillon. (Bull. Mens. Soc. Linn. Paris, i. 852, 853).

Descriptions of *R. colorata* from Peru, and *R. Chiquitensis* from Bolivia, (Weddell No. 3495).

Scribner—Professor F. Lamson. (Orchard & Garden, xii. 149, illustrated).

Biography, with portrait.

Shortia galacifolia. (Garden, xxxviii, 204, 205, plate 768).

The history of *Shortia* is here briefly given, accompanied by a full page colored plate of the plant.

Some Effects of the Mild Winter. Jacob Schneck. (Bot. Gaz. xv. 209–211).

The memoranda in this article refer to the vicinity of Mt. Carmel, Ills., and we are told that *Malva rotundifolia, Stellaria media, Alyssum maritimum, Capsella Bursa-pastoris, Bellis perennis* and *Lamium amplexicaule* were in blossom all winter and were only checked by a spell of cold weather in March.

Spruce Pine—The Florida. Carl Mohr. (Garden & Forest, iii. 402, 403).

Describes the habitat and surroundings of *Pinus clausa* with with its accompanying vegetation.

Sweet Gum—The. (Garden xxxviii. 208, illustrated).

An account of the introduction into England of *Liquidambar styraciflua* and its occurrence there.

Triumfetta semitriloba. H. H. Rusby. (Reprint from Drug. Bull. Aug. 1890, illustrated).

Tulip Tree—The. (Gard. Chron., viii. 218, 219, fig. 36).

A representation of a large tree in Kew Gardens.

Virginia Creeper—The. E. S. Goff. (Garden & Forest, iii. 392–394).

Attention is called, in this brief note, to the fact that *Vitis quinquefolia* seems to produce two well marked varieties, one producing sponge-like disks and hence climbing everywhere readily, the other producing tendrils without disks which assist the plant in clambering up rough surfaces only. We have seen mention made of these two varieties before, and the importance of distinguishing between them is often highly important when the vine is to be planted for ornamental purposes. Observation of the natural geographical distribution of the two forms would be valuable.

Water Lilies—Notes on Mexican. C. G. Pringle. (Garden & Forest, iii. 415). *Nymphæa Mexicana, N. elegans, N. ampla* and *N. gracilis* are described.

In regard to the latter species the author says: "Of the several species under consideration this one alone, as I believe, possesses any marked fragrance. Its root-stock is a tuber rather than a rhizome—or such at least it appears in autumn, after all the rest of the plant has perished—an ovoid body one to three inches in length, with thick and hard outer shell, covered with bosses quite like a pine cone in appearance. In this state the plant is prepared to hibernate and endure safely the droughts of the earlier months of the year, when many of the shallow lakes which it inhabits are dried up, and the land, where they lie tumbling about on the surface, is even growing a crop of wheat."

*West American Oaks. Part II.** E. L. Greene. Pamph. 4to., pp. 30, plates 13; San Francisco, Cal., June, 1890).

Part two of this splendid work has been issued under the same conditions as part one—Mr. James M. McDonald assuming the financial responsibility and Prof. Greene undertaking the necessary botanical explorations and descriptions. The general style of Dr. Kellogg's drawings has been preserved, so that there is a gratifying uniformity throughout, and this latter part is a fitting sequel to the great work so well begun. *Quercus Gilberti* and *Q. venustula* are described as new. A problematic specimen of *Q. Gambelli*, from Bear Creek Cañon, Col., is figured and so

* For review of Part i, see BULLETIN, xvi. 177, 178.

named, provisionally, but the author says that he suspects it may ultimately be found worthy of varietal rank. *Q. Jacobi* is figured on the same plate with *Q. Garryana*, Dougl., with which it has been frequently confounded, and *Q. Macdonaldi*, var *elegantula*, is figured and described as a probable hybrid between *Q. Engelmanni* and *Q. dumosa*. Changes from generally accepted names are few. *Q. Dunnii*, Kellogg, (1879) becomes *Q. Palmeri*, Engelm. (1876). The use of trinomials by the author we note again with regret, not only because they are frequently misleading in regard to the authority for the specific name, but also because it seems a needless innovation. As an example we may quote *Quercus Macdonaldi elegantula*, Greene, which is strictly correct, so far as the authority is concerned, as Prof. Greene is the author of both specific and varietal name, but when he writes *Quercus dumosa polycarpa*, Greene, it is misleading, for the reason that the name of Nuttall, the author of the species, does not appear. A. H.

Proceedings of the Club.

The regular meeting was held at Columbia College, Wednesday evening, Sept. 24th, the President in the chair and eighteen persons present.

Reports of several of the field excursions during the summer were received.

Mrs. Britton remarked on *Sabbatia stellaris*, forma *albiflora*, collected in abundance at South Beach, Staten Island, and on her discovery of spurs on the two outer sepals of *Impatiens biflora* at New Dorp. She also stated that *Habenaria ciliaris* was exceedingly abundant in flower at Linden Park, whereas last year only two or three plants were found in bloom. The President suggested that this species might be uniformly biennially flowering. Mr. Ogden reported it in full flower at Tenafly, N. J., this season, and the Secretary stated that flowers were abundant at that station in 1888.

Dr. Newberry remarked on his recent trip to the Adirondack region.

Mrs. Northrop gave a preliminary account of the vegetation of the Bahama Islands.